Course Title: Communication systems	Course Code: EEC2247	Second Year
Date: 9-6- 2012 (second term)	Allowed time: 3 hrs	No. of Pages: (2)

Answer all the following questions:

Question (1) (20 degrees)

(1) Find the complex Fourier series of the periodic square waveform shown below in the Figure

(1) over the time interval $0< t <1$, $v(t)$ is described by e^{t}, and find the normalized average power..

(2) Find the trigonometric Fourier series of the periodic waveform shown in Figure (2).

(3) State that, the average power of the periodic signal over a 1-ohm is given as:

$P = \sum_{n=-\infty}^{\infty} |C_n|^2$, where C_n is the complex Fourier coefficient.

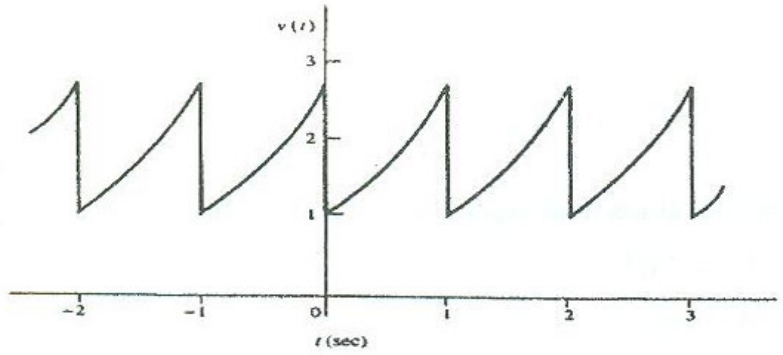

Figure (1)

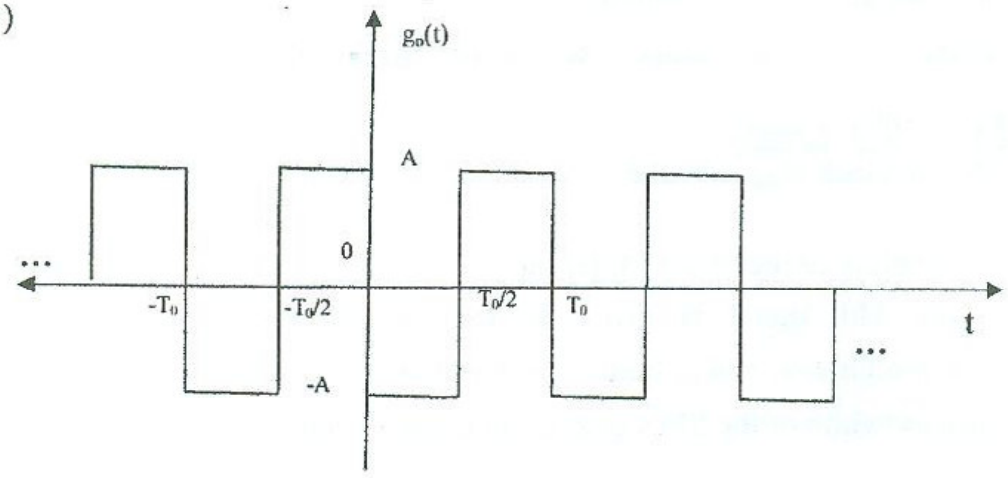

Figure (2)

Question (2) (20 degrees)

(1) Determine the Fourier transform of the following functions:

(a) $x(t) = \begin{cases} e^{-t/2}\sin(2\pi f_o t) & t > 0, T > 0 \\ 0 & t < 0 \end{cases}$

(b) $w(t) = 5 - 5e^{-2t}u(t)$

(2) The Fourier transform of a signal $g(t)$ is denoted by $G(f)$. Prove the following property of the Fourier transform:

$$\int_{-\infty}^{\infty} g(t)dt \Leftrightarrow \frac{1}{j2\pi f}G(f) + \frac{G(0)}{2}\delta(f)$$

(3) Find the Fourier Transform of the waveform given by:

$$w(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_o)$$

Question (3) (20 degrees)

(1)Show, how the square-law modulator can be used to generate the AM wave.

(2) An amplitude modulated (AM) wave is represented by the expression

$s(t) = 5[1 + 0.6\cos(6280t)]\cos(2\pi \times 10^4 t)$ *volts*, Find the following:

(a) Modulation the depth and f_m.

(b) The power of AM wave and sketch the AM waveform.

(c) Determine the frequencies in the USB and LSB spectra.

(d) Explain one type of the demodulators that can be used to recover the baseband signal from the AM wave.

Question (4) (20 degrees)

(1) Describe with the block diagram, how the Costas receiver can be used for demodulating the DSB-SC wave.

(2) An SSB-AM transmitter is modulated with a sinusoidal signal $m(t) = 4\cos(1000\pi t)$, , with carrier amplitude $A_c = 2, and \quad f_c = 2\,kHz$.

(a) Find the expression for an upper SSB signal.

(b) Sketch the amplitude spectrum of $|S(f)|$.

(c) Find the normalized average power of the SSB signal.

Question (5) (20 degrees)

(1) Explain with the block diagrams the method that can be used to generate a narrow-band FM wave.

(2) Illustrate the working of the PLL FM detector.

(3) A single-tone FM signal is given by $s(t) = 10\sin[16\pi \times 10^6 t + 20\sin(2\pi \times 10^3 t)]volts$. Determine the modulation index, frequency deviation, the instantaneous frequency $f_i(t)$, and calculate the bandwidth of the FM signal using Carson's rule.

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Good Luck

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